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ABSTRACT

As part of a project that identified the specific literacy skills required in ten occupations, this report provides two levels of instructional information about draftsmen. Factual data are presented in Parts I and II for use in decision making by program developers, administrators, teachers, and counselors. These sections note the specific literacy requirements (reading, writing, listening, speaking, and mathematics) that were identified at three job sites and in three vocational training programs. Part III presents instructional methods/materials that adult basic education teachers can use to develop literacy skills while imparting job related knowledge. The lesson format is based on a directed reading activity and includes vocabulary and concept development, sentence and organizational structure, silent reading, and skill development. Appendixes list the technical vocabulary that draftsmen need to know, the 100 words that represent 45% of the language sampled for the entire project, and occupational literacy requirements for the ten occupations that were studied. (AEA)

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THE LITERACY REQUIREMENTS OF A DRAFTSMAN ON THE JOB AND IN A VOCATIONAL TRAINING PROGRAM

ED182697

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PROJECT ABSTRACT

THE IDENTIFICATION OF LITERACY REQUIREMENTS OF JOBS IN INDUSTRY AND CORRESPONDING VOCATIONAL TRAINING PROGRAMS

1.	**Need Addressed:**	Meeting the educational needs of adults with minimal literacy skills who wish to enter skilled or semi-skilled occupations.
2.	**Population Served:**	Adults with minimal literacy skills.
3.	**Brief Description:**	Specific literacy requirements (reading, writing, listening, speaking, and mathematics) of semi-skilled and skilled occupations in business, industry and vocational training programs were determined. The literacy demands of three work contexts and training programs for each of the ten occupations were analyzed and reported.
4.	**Major Objectives:**	To provide educators, counselors, and administrators with a description of the literacy requirements of semi-skilled and skilled occupations and training programs to which functionally illiterate adults aspire.
5.	**Products:**	A description of the literacy requirements necessary to hold a job in each of ten occupations and the corresponding requirements necessary to succeed in vocational training programs which prepare individuals for each of those occupations is provided. A booklet for each of the ten jobs was prepared.

INTRODUCTION

This project was undertaken in response to a need, expressed by adult basic educators and counselors, for information about the specific literacy skills necessary for success in several occupations. The occupations studied had been identified as desirable careers during informal interviews with adults who were enrolled in basic education programs in the Lafayette, Indiana area. Employment counselors and officials of the Office of Career Development confirmed that the occupations identified for study were appropriate. Because Greater Lafayette offers a wide range of occupational and training opportunities, the project staff was able to study both job sites and vocational training sites for each of the following occupations: account clerk, automotive mechanic, draftsman, electrician, heating and air conditioning mechanic, industrial maintenance mechanic, licensed practical nurse, machine tool operator, secretary, and welder.

Purpose and Audience

This report provides descriptive and instructional information to adult educators at two levels. Factual data are presented in Parts I and II for use in decision making by program developers, administrators, lead teachers, and counselors. Part III presents instructional methods and materials and is meant for use by adult basic education teachers. Members of both groups may be interested in the entire report, but in preparing it the project staff attempted to address the needs of the two audiences separately.

Procedures

To identify reading, writing, speaking, listening, mathematics, and other characteristics which are necessary for success both on the job and in the training program, three job sites and three vocational college courses were studied.

Required reading materials from each of the six settings were evaluated using two widely used readability formulas, the Dale-Chall Formula and the Fry Readability Graph. Readability estimates were computer assisted. A minimum 2000 word sample of written language was taken from each site. Special considerations and problems related to reading the technical materials were identified, and the relative use of reading as a work tool and as a learning tool was determined.

To identify speaking and listening requirements, one hour samples of oral language were recorded at each job site and in each vocational college course. Language recorded at each site was rated for its technical and formal qualities, and computer-analyzed to assess vocabulary and syntax. Written and oral language samples were used to develop the Key Technical Vocabulary List found in Appendix A. The combined language samples from all occupations studied were used to develop the Highest Frequency Word List found in Appendix B. A summary of the literacy requirements for all ten occupations studied is found in Appendix C.

Writing samples were obtained at each of the six sites and used to determine the nature of written communication demands on the job and in the vocational training program.

Mathematics demands were determined through surveys of materials from the job sites and classrooms. Instructors and supervisors

responded to a questionnaire about the specific mathematics skills necessary for job and/or training program success.

Important non-literacy characteristics were identified by supervisors who completed a rating scale which asked for their estimate of the importance tc job success of such factors as cooperativeness, reliability, and attitude toward work.

The following sections of this report are organized according to the requirements of the job, the requirements of the training program, and instructional recommendations.

PART I

REQUIREMENTS ON THE JOB

Job Sites Studied

At each of three separate job sites the literacy demands placed on one draftsman were studied. Reading, writing, oral language and mathematics were the specific literacy skill areas examined. The roles of the workers studied were similar, but the industries in which they worked varied. One worker was concerned mainly with the building and construction business. A second worker focused on electrical drawings and diagrams. The third concentrated on metal fabrication drawings. From each job site, representative samples of the reading, writing, and mathematics tasks done on the job were obtained. Samples of oral language requirements were obtained by recording a randomly selected one-hour period of on-the-job verbal interaction. At each job site, the worker's immediate supervisor completed a questionnaire which was concerned with the importance of eleven worker characteristics. Supervisors were also asked to identify the mathematics skills necessary for job success and to estimate the amount of time per week the workers spent using mathematics and reading skills.

Reading Requirements

Persons succeeding in the drafting occupation need highly developed reading skills. Supervisors stated that reading was necessary only about 10 percent of the time, but that the difficulty level of the required materials was very high. Reading materials from the job sites included building code books, building specifications manuals, engineering handbooks, reference books commonly used in drafting occupations, and technical drawings and diagrams. The required reading materials involved sentence/paragraph format as well as tables, charts, and other graphic formats for the presentation of information.

The style of writing encountered in most of the materials studied was highly technical. Handwritten memos from supervisors were less technical than other materials, yet they contained highly specialized words and concepts. Example I illustrates the technical language encountered at two of the drafting job sites studied.

EXAMPLE I

Drafting Reading Requirements

A. Construction Specifications

"Entrance doors shall be one of the following, per design:

(1) One-lite glazed 8" x 30" with wire glass, 1 3/4" thick flush 24 gage [sic] galvanized steel with laminated kraft honeycomb core and polyurethane foam, for sound deadening and insulation, prepainted spitfire orange. Frames for one-lite inserts are wood, painted brown." (National Commercial Structures, 1978, p. 13).

B. Fire Code

"The requirements of Part V are for the various Types of Construction and represent varying degrees of public safety and resistance to fire. Every building shall be classified by the Building Official into one of the Types of Construction set forth in Table No. 17-A." (Uniform Building Code, 1976, p. 100)

The difficulty of the required reading materials was estimated by computer analysis using the Dale-Chall Formula and the Fry Readability Graph. Because several materials were examined at each job site, and because of variation in the estimates made by the two methods, Table I, below, presents readability levels in ranges of difficulty. A range of 10th to 12th grade level would indicate that the materials evaluated were similar in difficulty to materials used in high school.

TABLE I

Readability Estimates for On-The-Job Materials

Job Site One	10th grade to college graduate level
Job Site Two	11th grade to college graduate level
Job Site Three	11th grade to college graduate level

Readability formulas do not take into account reader familiarity with difficult concepts and unusual vocabulary. It is likely, therefore, that persons in drafting positions at the job sites studied who read required drafting materials on a daily basis without difficulty

would have had difficulty with high readability level materials from unfamiliar areas of specialization. In fact, military studies suggest that workers were able to successfully use familiar materials several levels higher than their measured reading abilities should have allowed (Sticht, 1974). The implications of this research for ABE instruction are discussed in Part III of this report.

Special Reading Considerations and Problems

The predominant style of writing encountered in on-the-job reading materials was technical, as illustrated in Example I. Draftsmen who participated in the study reported that much of the reading that they did involved finding important information in texts or in tables of figures. Specifications manuals and code books were the most frequently mentioned materials. Careful reading of specifications documents was cited as critical by one worker who stated that up to 75% of customer job requirements were conveyed through specifications sheets.

Another indication of the importance of thorough, careful reading was found in the response of a worker when asked if reading required materials incorrectly would affect him or his work. His response was, "Definitely! The entire reliability of our finished product may rely on proper sizes and testing requirements derived from [reading] the code."

In addition to specifications and code books, other required reading materials included catalogs, bulletins, approval drawings, and professional reference books. Example II shows textual and tabled

information formats common to the required reading materials from the drafting job sites.

EXAMPLE II

Formats Used in Presenting On-The-Job Information

A. Textual Format

INSPECTION OPENINGS

"(a) All pressure vessels for use with compressed air, except as permitted otherwise in this paragraph, and those subjected to internal corrosion, or having parts subject to erosion or mechanical abrasion (see UG-25) shall be provided with a suitable manhole, handhole, or other inspection openings for examination and cleaning." (Pressure Vessel Codebook, p. 42)

B. Tabled Information

BUILDING ELEMENT	TYPE I	TYPE II			TYPE III		TYPE IV	TYPE V	
	NONCOMBUSTIBLE				COMBUSTIBLE				
	FIRE RESISTIVE	Fire Resistive	1-Hr.	N	1-Hr.	N	H.T.	1-Hr.	N
Exterior Bearing Walls	4 Sec. 1803 (a)	4 1903 (a)	1	N	4 2103 (a)	4 2103 (a)	4 2103 (a)	1	N
Interior Bearing Walls	3	2	1	N	1	N	1	1	N
Exterior Nonbearing Walls	4 Sec. 1803 (a)	4 1903 (a)	1	N	4 2103 (a)	4 2103 (a)	4 2103 (a)	1	N

(Uniform Building Code)

Materials which presented information in the above formats clearly illustrated the need for specialized job-related knowledge and well-developed skill in obtaining information from printed materials.

Uses of Reading on the Job

From the questionnaire discussed above, it was concluded that most of the reading required of the draftsmen who participated in the study was done to obtain important information. The workers indicated that in most cases it was not necessary to remember the information for more than a few hours. It was also remarked by the workers that key information would be looked up again rather than entrusted to memory. Thus, reading was used on an almost continuous basis to find and check data. Estimates of time spent in sustained reading ranged from two hours to twelve hours per week. In every case, it was stated that incorrect reading of required materials would affect the worker and others as well.

Although reading was used primarily to accomplish work with little need for remembering the information obtained, the use of professional reference books often required reading to be employed as a learning tool. Information obtained from reference books usually concerned methods or techniques for accomplishing particular types of drawings. Such information was memorized and integrated into the drawing skills of the worker with only an occasional need for review. Both types of reading skills, reading to do and reading to learn (Sticht, et al, 1977), are discussed in Instructional Recommendations, Part III of this report.

Writing Requirements

Among the ten occupations studied, the writing requirements of drafting were unique. In general, the use of standard 'grammatical'

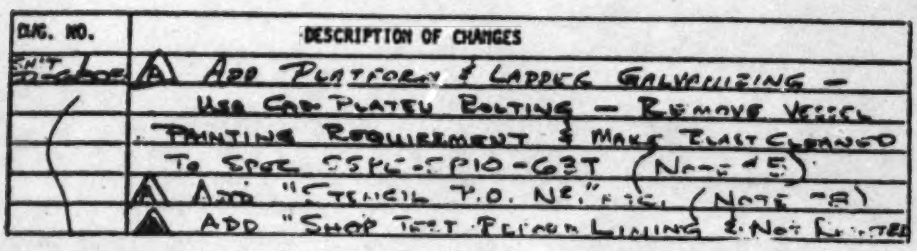
English sentence structure was not required. Memoranda, for example, were written in informal economical style and only words that were essential appeared on drawings and diagrams.

The importance of legibility varied greatly depending on the tasks involved. Memoranda were written with degrees of legibility that might have occurred in any occupation. Parts lists or specifications lists for use by the workers and their coworkers were printed in a legible manuscript style. Final drafts of drawings or documents, however, were lettered in a uniformly precise and highly legible style. To the untrained observer, the lettering work from all three job sites seemed to have been done by the same individual. Example III illustrates two forms of writing required at the drafting job sites.

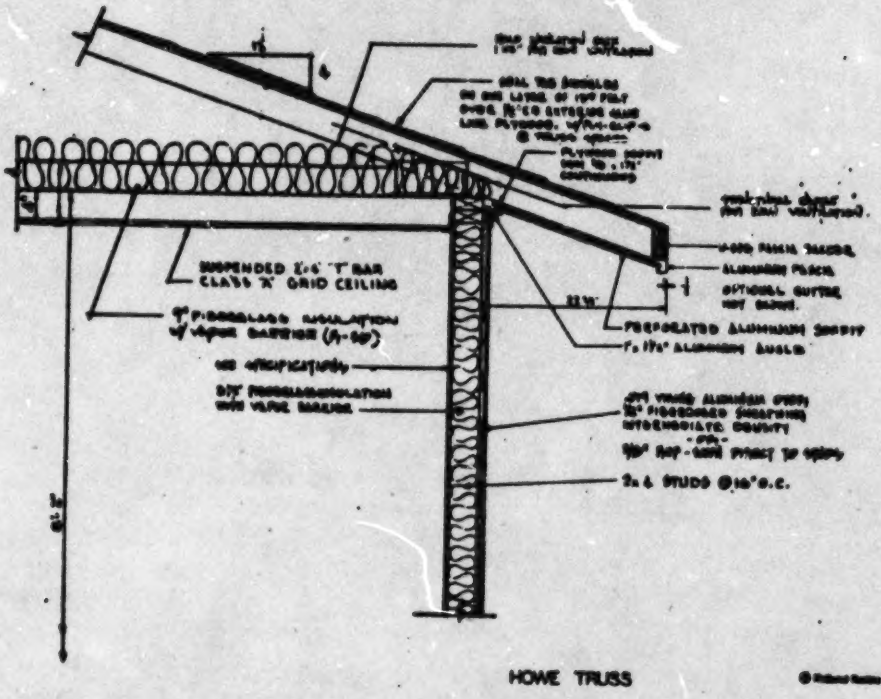
EXAMPLE III

Writing Required at Drafting Job Sites

A. Informal Legible Manuscript


DWG. NO.
DESCRIPTION OF CHANGES
ADD PLATFORM & LADDERS GALVANIZING -
USE CAD PLATED BOLTING - REMOVE VESSEL
PAINTING REQUIREMENT & MAKE BLAST CLEANED
TO SSPC-SP10-63T (NOTE 15)
ADD "STENCIL T.O. NE." ETC. (NOTE 8)
ADD "SHOP TEST PETROLIN LINING & NOT LIMITED

B. Formal Manuscript Style



HOWE TRUSS

Mathematics Requirements

The mathematics demands of the jobs studied were high. Supervisors' responses to a questionnaire about the use of mathematics on the job revealed that mastery of geometry, algebra and trigonometry was required. The amount of work time spent on mathematics-related activities ranged from five to twelve hours per week. Thus, mathematics was used more frequently than reading in accomplishing work. In comparing the importance of mathematics skills to the importance of reading skills, one supervisor rated them equally, one rated mathematics higher than reading, and the third rated reading skills higher than mathematics skills. All drafting supervisors rated mathematics

skills as highly important to job success.

Example IV contains a mathematics problem found at a drafting job site.

EXAMPLE IV

A Drafting Mathematics Problem

"(a) Ellipsoidal Heads. The required thickness of a dished head of semi-ellipsoidal form, in which half of the minor axis (inside depth of the head minus the skirt) equals one-fourth of the inside diameter of the head skirt, shall be determined by:

$$t = \frac{PD}{2SE-0.2P} \quad \text{or} \quad P = \frac{2SE}{D + 0.2t}$$ "

(American Society of Mechanical Engineers, 1977, p. 27)

A survey of drafting on-the-job mathematics materials, of which the above is a representative sample, indicated that fairly sophisticated mathematics skills were important to job success.

Oral Language Requirements

Oral language recorded at the job sites combined informal styles of speech with job-related, technical concepts and vocabulary. Conversation was at times not job-related, but as a rule it focused on aspects of job-tasks that were being performed. Giving and following verbal directions were important abilities noted on the tape recordings. Much job-related conversation involved verbal instructions such as that shown in Example V.

EXAMPLE V

On-The-Job Verbal Interaction

". . . what happens is, see, you got a-- you take one wire to this point which keeps down the number of connections per terminal also. And also keeps the wires as short as possible, because I wouldn't run from here all the way over to here, and then come back to this point because I increase the number of wires. See what I mean?"

Key Non-Literacy Requirements

Supervisory personnel rated several worker characteristics according to their importance to overall job success. The following characteristics were rated as very important by all of the supervisors:

Ability to work cooperatively with others

Good record of attendance

Positive attitude toward work

Ability to communicate through speaking

Ability to follow spoken and written directions

Ability to read blueprints

In addition to rating the above qualities, the supervisors added that self-motivation, ability to work well under pressure, and speed and accuracy were also very important.

An interesting result of the rating scale is that all of the qualities listed above were rated more important than reading and mathematics abilities. Moreover, one supervisor, who voluntarily

added "drafting ability" to the list of characteristics, rated the first six characteristics listed above to be more important than drafting ability in achieving job success. The implications of these findings for ABE instruction are discussed in Part III of this report.

PART II

REQUIREMENTS OF THE VOCATIONAL TRAINING PROGRAM

The Courses Studied

The reading, writing, oral language, and mathematics requirements of three courses in a vocational college drafting training program were studied. The courses, Heavy Construction Detail, Sheet Metal Drafting, and Statics (vector analysis, truss analysis, and centroids) were determined by the school administration and instructional staff to be representative of the drafting training program as a whole. In other words, the literacy demands placed on students in other drafting courses were judged to be about the same as those presented here.

Each of the courses studied combined the use of readings and lectures with practical projects designed to simulate experiences found in industry. There were many opportunities for students to relate written and spoken information to real materials and activities. Reading, writing, mathematics, and oral language skills were routinely used in classroom learning experiences in all three courses studied.

Reading Requirements

The demands for reading and other literacy skills are typically

higher in training programs than on the job. This is due to the need to present large quantities of information during a relatively short period of time. In the drafting program, the difference between on-the-job and training program reading requirements is qualitative rather than quantitative. That is, the amount of time spent on reading tasks is about the same in both environments, but on the job, reading is primarily used to accomplish work. In the training program, on the other hand, reading is used more frequently as a tool for learning.

Instructor estimates of the amount of time per week spent on required reading tasks were one hour for the sheet metal course, two to three hours for the heavy construction course, and ten to twelve hours for the statics course. In the statics course, the instructor noted that reading and mathematics skills were applied simultaneously in problem solving.

The style of writing found in vocational training program reading materials was, like that found in on-the-job materials, highly technical. Excerpts from typical training program reading materials are presented in Example VI.

EXAMPLE VI

Vocational Training Program Reading Materials

A. Sheet Metal Drafting

"Fig. 2-35. To draw an ellipse by intersection of lines ---Draw the major axis AB 3-1/2" long, and the minor axis MA' 2-1/4". Through m parallel to line AB draw line CD. From points A and B erect perpendiculars to line CD." (Daugherty, 1975, p. 18)

B. Heavy Construction Drafting

"Lumber is usually computed by the Board Measure, B.M., the unit being a square foot one inch thick. Any number less than one inch thick is usually computed as one inch thick. (One exception to this is plywood; it is measured in square feet because it is sold in the form of panels.) Framing Square Method. The back of a blade of a typical framing square is shown in Fig. 4-19. On the back of this blade is the Board Measure . . ."

(Steinberg and Stempel, 1973, p. 90)

C. Statics

"A member which is acted upon by two forces--for example, one at each end--is known to be a two-force member. A two-force member will always be in either tension or compression.

When a member is acted upon by at least three forces at several locations, there will be not only tension and compression, but also bending." (Walker, 1974, p. 73)

The levels of readability difficulty of the materials required in the training program were not as high as those found at the job sites. Research, however, suggests that difficult concepts should be presented to learners through more readable formats than are used by readers who are familiar with the concepts (Duffy, 1976). The effect of using lower readability materials in training programs is to enable students to acquire basic job-related knowledge without taxing their reading skills.

Table II, below, presents the levels of readability for materials used in the three drafting courses. As in Part I, estimates are reported as ranges.

TABLE II

Training Program Readability Estimates

Course One	Ninth grade to college level
Course Two	College level
Course Three	Seventh grade to college level

It was noted in Part I of this report that readability formulas do not account for factors such as motivation and familiarity with the subject matter. The notion that motivation and knowledge of subject matter can reduce the perceived difficulty of reading materials is discussed in Part III, Instructional Recommendations.

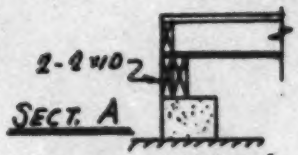
Special Reading Considerations and Problems

Although finding information in texts, tables, figures and charts for immediate use was the predominant reading skill applied on the job, skill in using reading as a learning tool was predominant in the training program. Neither reading to do nor reading to learn was used exclusively on the job or in the training program.

Reading tasks in the training program required a balance of precision and the ability to identify and remember important information. Textbooks contained tables and figures similar to those found in the code books used on the job as well as information presented in sentence/paragraph format. Typical training program reading materials are illustrated in Example VI, above. Tables of key information were similar to that illustrated in Examples II and VII.

EXAMPLE VII

Typical Tabled Information



OUTER SILL ROWS

		L.L.
Roof - (40)(14)	= 560 #/'	420 #
Wall	= 50 #/'	0
Floor (56)(6)	= 336 #/'	300
	946 #/'	720 #/'
	= 78.8 #/'	= 60.0 #/'

$S = 42.78\ in^3$
$I = 197.86\ in^4$

Bending: $l = \left[\frac{8S}{w}\right]^{1/2} = \left[\frac{8(1550)(42.78)(1.15)}{78.8}\right]^{1/2} = 88" > 84"$ (82)

Defl. $l = \left[\frac{384EI}{5Cw_L}\right]^{1/3} = \left[\frac{384(1.7\times10^4)(197.86)}{5(360)(60)}\right]^{1/3} = 106" > 84"$ (82)

INNER SILL ROW $S = 42.78\ in^3$ $I = 197.86\ in^4$

Floor - 56(12) = 672 #/' = 56.0 #/' $w_L = 12(50) = 600\ #/' = 50\ #/'$

Bending: $l = \left[\frac{8(1550)(42.78)}{56.0}\right]^{1/2} = 97" > 84"$ (82)

Defl. $l = \left[\frac{384(1.7\times10^4)(197.86)}{5(360)(50)}\right]^{1/3} = 113" > 84"$ (82)

Uses of Reaidng in the Vocational Training Program

As previously discussed, reading in the training program involved both reading to accomplish work and reading to learn. The use of reading as a learning tool involved materials similar to those illustrated in Examples I, II, III, IV, and VI above. Examples II and VII illustrate tables encountered in reading-to-do tasks.

Writing Requirements

Vocational training program writing requirements were similar to those observed at the job sites (see Example III in PART I). That

is, informal style was used in responding to questions in written assignments and examinations. Sentence structures used were complete and grammatical on more formal assignments and drawing tasks, but paragraph-length written work was uncommon.

Wide variation in legibility was observed. Informal assignments and written communication were done in a style similar to that found in the other non-drafting occupations studied. Written manuscript work for formal drawings and diagrams, however, was uniformly neat and highly legible.

Mathematics Requirements

Each instructor who participated in the study completed a questionnaire which asked for an estimate of the importance of several mathematics skills to succeed in the drafting training program. In terms of the skills required, the results of the questionnaire were identical to the results of the same questionnaire when completed by supervisors on the job; mathematics skills from basic computational processes through trigonometry were required. Estimates of the amount of time per week spent on mathematics-related activities ranged from two to six hours. According to instructors, more student time was spent on mathematics work than on reading tasks.

Oral Language Requirements

The style of language recorded during training program lectures was typically informal. The subject matter in the lectures, however, was highly technical; comprehension of lectures required some prior knowledge of the subject matter and attentive listening on the part of

the students. The ability to follow verbal directions and the ability to take coherent notes was also necessary. Likewise, students were expected to relate illustrations on chalkboards and in textbooks to the instructor's remarks during lectures and demonstrations. The excerpt in Example VIII is typical of classroom language which emphasized listening ability.

EXAMPLE VIII

Drafting Program Classroom Language

"All right. And then you only have X and Y, we're not selling moments without points. OK. To do that, let's all use an X and Y and co-planer or concurrent forces. OK, either are designed by compression or tension. OK? And if they're designated by compression or tension, that means that you don't have, oh say, this is uh, A and this is B, you don't have an ABX. Uh, that would be a bad example . . ."

PART III

INSTRUCTIONAL RECOMMENDATIONS

Project Overview

For the drafting occupation, reading, writing, oral language, and mathematics skills required on the job and in the vocational training program were generally high level.

The levels of reading skills required on the job were estimated to be in the range of upper high school level to college graduate level. In the vocational training program, the estimated readability of required materials extended from seventh grade level to college level. It was noted in previous sections of this report that knowledge of key technical concepts and vocabulary, combined with the familiarity gained through daily use of required reading materials, may reduce the perceived difficulty of reading tasks.

On the job and in the vocational training program reading was used as a tool for accomplishing work and as a tool for learning. Reading-to-do work was predominant on the job where reading was used to find information and to check specifications. Supervisor's estimates of the amount of time draftsmen spent on job-related reading ranged from a few hours per week to continuous use of reading.

In the vocational training program, reading was used more often as a learning tool than it was on the job. However, reading-to-do tasks requiring careful, precise attention similar to on-the-job tasks occurred frequently.

Writing requirements for the drafting occupation were unique in that high levels of legibility were often required. When written memoranda were required, the writing of the draftsmen varied widely in style and legibility, but in formal drawings and diagrams, lettering was uniform and highly legible. Complete sentences and paragraphs were observed less often than were concise phrases and partial sentences in the writing samples obtained from both job sites and training program courses.

The level of mathematics skills required by the jobs and training courses examined in the study was, like reading skills, very high. Skills ranged through trigonometry. The amount of time spent on mathematics related tasks on the job and in the training program was greater than the amount of time spent on reading tasks.

The jobs and the training program required the ability to make use of oral instructions and directions given by supervisors and instructors. Note taking skills and the ability to relate verbal information to graphic illustrations were also necessary.

Job site supervisors, when asked to rate several worker characteristics in terms of their importance to job success, rated the following as very important: good attendance, positive attitude toward work, ability to work cooperatively with others, ability to communicate through speaking, ability to follow both oral and written

directions, and the ability to read blueprints. All of these qualities were rated higher than reading or mathematics abilities by the supervisors. Moreover, one supervisor rated the qualities listed above as more important than drafting ability.

A brief summary of how the literacy requirements of drafting compare to those of the other nine occupations studied is found in Appendix C.

Organization of ABE Lessons

The recommendations which follow are meant to aid teachers and tutors in designing streamlined lessons which develop literacy skills while imparting job-related knowledge. The majority of the literacy information studied in connection with drafting occupations and training programs was related to reading. Reading demands were found to be high, and even when mathematics, writing, and oral language skills were used by workers and students, they were used in conjunction with reading. This section, therefore, presents background information and a method of organizing ABE lessons which emphasizes reading. Background information provided deals with the teaching of vocabulary and teaching about text structure and organization. The lesson format is based on a directed reading activity (DRA) and includes vocabulary and concept development, sentence and organizational structure, silent reading, and skill development.

The guiding principle of a DRA method of lesson organization is that words, concepts, and skills must be introduced and practiced in situations and materials that are true to life. For example,

words, sentences, tables, and illustrations should be similar to those used on the job or in the training program. It may be possible to teach an interested ABE student all of the words on the Key Technical Vocabulary List in isolation, but a far better practice is to introduce and practice such words in contexts similar to those found in occupational reading materials. In the case of ABE lessons, there may be a wide gap between the reading requirements of occupational materials and the reading abilities of the student. Materials which parallel those found on the job and in the training program can be developed by teachers and tutors if time permits. Through paraphrasing sections of textbooks, reference books and manuals, the readability of occupational materials can be reduced so that literacy skills and job-related knowledge can be developed simultaneously.

The value of a DRA approach is that it allows the use of any appropriate reading material in a job-related reading skill development program.

Notes on Teaching Vocabulary

The specialized vocabularies of draftsmen are largely determined by the area of industry in which they work. There are, however, many key concepts and words which are common to the drafting occupation in general.

The specialized technical words of the Key Technical Vocabulary List should be taught to ABE students interested in entering the drafting field so that both the words and their meanings are recognized. This implies that the words will be taught in a meaningful context.

Two types of specialized vocabulary words occur in specialized fields such as drafting. One type of word is unique to the specific field. The word "centroid" has a very specific meaning to draftsmen working in construction engineering fields, but persons outside of that field probably have never encountered the word. In teaching ABE students words such as centroid, an illustration of its meaning would be essential.

A second type of word which needs attention in ABE lessons is one which has a common meaning in everyday communication, but which also has a specialized technical meaning. The word "flashing" is usually used as a verb and has several connotations in everyday usage. In light construction fields, however, flashing is used as a noun referring to sheet metal used in waterproofing roofs. Multiple meanings like these should be pointed out during reading lessons.

It is important for ABE students to be introduced to common high-frequency words and specialized vocabulary words via contexts which are similar to those found on the job and in the training program. As noted previously, this practice develops basic job-related knowledge and reading ability.

The following are suggestions for teaching vocabulary:

1. Pair the word to be taught with the concept or object that it refers to whenever possible.
2. Introduce the word using an approach which focuses student attention on the word.
3. Be sure that the new word is read in context very soon after it has been taught.

4. If in doubt, use the general rule that four to six new words per lesson be introduced. Learning and recall are typically most efficient when the number of words taught is in this range.
5. Review vocabulary words frequently.

Sources of job-related vocabulary words and concepts are included in the books cited in the bibliography of this report. The style and level of writing in the listed materials is often highly technical, thus, teacher time could be devoted to preparing lower readability materials which parallel high-level passages.

Notes on Teaching About the Structure and Organization of Text

The above suggestions on teaching vocabulary words emphasize meaning; words have little use outside of a meaningful context. In the field of drafting even solitary words on a chart or diagram have a meaningful context to a trained individual.

In reading, it is important to be aware of special patterns of organization used by writers. Formal technical reading materials are organized differently from the short stories and novels used in teaching reading to most Americans. The expository style of writing used in textbooks and other specialized or technical materials is different from the narrative style of stories and novels at several levels of comparison.

At the sentence level, ABE students should learn that expository style often relates cause and effect. Sometimes this relationship is clearly stated as in the sentence in Example IX-A.

EXAMPLE IX

Stated and Unstated Cause and Effect Relationship

A. The structure collapsed because of poor design.

B. The structure was poorly designed. It collapsed.

Often, however, the relationship is not stated, as in Example IX-B. In such cases, readers who are not expecting cause and effect connections may miss them.

At the paragraph level, writers of expository material often use a format which states the main idea in the first sentence. The last sentence summarizes the paragraph and may connect it to a paragraph that follows. Comprehension and learning can be improved when readers are aware of this organizational technique.

At the chapter level, expository material may contain many valuable aids to efficient reading. Key words are used as headings which introduced important sections. Pictures, diagrams, tables, and figures are used to illustrate important ideas. Introductions and chapter summaries are also available as aids to readers who know how to use them.

ABE students should learn about style factors such as these and use them to enhance comprehension. Efficient readers use their knowledge of expository style to organize their reading. Awareness of the use of cause and effect makes them sensitive to such relationships. Knowledge of paragraph and chapter organization is used to develop a 'mind set' which is helpful in organizing and remembering important information. Reader-composed questions based on paragraph

lead-sentences, headings, pictures, and other graphic aids help readers organize, comprehend and remember what is read.

A directed reading activity, described in the next section, is a system which enables the ABE student to become efficient in using organizational factors as aids to comprehension and memory.

Directed Reading Activity

This system of preparing for efficient reading may be used with individual students or with groups. In groups, it requires very little class time to prepare students for reading assignments. For both individual and group use, it has been demonstrated to increase reading efficiency and comprehension.

After a review of previously taught, related concepts and assignments, the below procedures should be followed:

I. Develop Readiness for Reading the Assignment.

Purpose: Motivate
Set purposes for reading
Develop vocabulary

Teacher role: Ask Questions -

How familiar is the subject matter and vocabulary to your student?

Teach New Vocabulary -

Be concrete: write out the words as you introduce them. Use examples, such as objects or pictures, point out word relationships; i.e., cardiograph and cardiovascular relate to cardiac - heart. Have students write the words as they are taught.

Ask Questions to Stimulate Interest-

Focus on titles, pictures, graphs. Relate an anecdote from your own experience or one your students might have had.

II. Direct the Silent Reading of the Assignment.

Develop questions from sub-headings, graphs, pictures, and tables. Try to focus on relationships in the assignment. In textbooks, useful questions are often provided by the authors.

Have pupils read silently from 5 to 20 minutes to find the answers (keeping questions in mind as they read).

Encourage students to ask for help when they are confused. Writing questions down in shorthand form is a good practice when reading is done outside of class.

III. Discuss Student Answers to Questions

Do not restate the questions unless necessary. Students need to remember the questions, or they lose the purpose for reading.

Ask higher level questions to develop comprehension (have student(s) interpret, draw conclusions, and make inferences as well as recall facts).

IV. Reread as Necessary

When answers demonstrate confusion, have the student reread the appropriate small section to determine the reason for the confusion.

V. Follow-up and Skill Development

Confusion or lack of comprehension may signal a need for extra work on vocabulary, concept building, or word recognition skill.

In this phase of the lesson, important mathematics and other skills can be related concretely to the reading assignment.

REMEMBER:

A DRA is a system, a routine, that you want your student(s) to learn to use independently. Remind your students of this - tell them why you use a DRA system. It will help them now and in their future study.

Reading to Accomplish Work

The term, reading to do, has been used in research and development projects done for the U.S. armed forces (Sticht, et al., 1977). Reading to do refers to the use of reading for the purpose of getting work done. It involves following written directions and reading to find information which will be used immediately. Such information need not be learned or remembered. Looking up telephone numbers; finding information in a policy manual; or finding important data in a table, chart, or figure, are examples of reading to do. Preparation of ABE students for reading-to-do tasks can be incorporated in a directed reading activity lesson.

When lesson materials contain occupationally relevant concepts, ABE students are given important background information which will make higher level training easier. Therefore, lessons should employ materials which are similar in structure and content to those found on the job or in the vocational training program. Paragraphs, tables, charts, and figures might be used verbatim from on-the-job or instructional materials. Alternatively, such materials might be paraphrased and reduced in difficulty to match student abilities.

Given appropriate materials and a period of orientation to them, the structural and organizational features of the table, chart, figure, paragarph, or chapter, should be pointed out to the student (see Notes on Teaching About Structure and Organization of Text). This is essentially the first step of the DRA described above. When the materials have been introduced, the student should be directed to find

a particular fact in the material. (In subsequent lessons the difficulty of information-finding tasks should be increased).

Skill in following written directions can be developed using a DRA system and materials similar to Example X. Initial activities should contain only one or two steps to follow.

EXAMPLE X

Written Directions

1. Listen to the directions on the Presentation Tape and execute those directions in Book I.
2. Do the Supplementary exercises for that lesson in Book II.
3. Complete the Self-Check for that lesson.
4. Take the information from the Dictation Tape for that lesson, reading back portions of it from your notes.

In information-finding lessons, the emphasis should be on understanding and careful identification of the required fact. Likewise, in lessons on following directions, understanding and careful execution of the required steps must be emphasized.

Reading to Learn Information

Skill in learning printed information for future use is very important in vocational training programs. The reading skills necessary for reading to learn (Sticht, et al., 1977) are taught and systematically practiced in directed reading activity lessons. That is, the use of previewing, attention to graphic and contextual

information, and the organizational factors discussed in Notes on Teaching About the Structure and Organization of Text, above, should be practiced and learned during each DRA lesson. Questioning and re-reading, also aspects of a DRA, reinforce important learning skills.

Sources of materials for use in reading-to-learn lessons, like those employed in reading-to-do lessons, should be occupationally oriented (See Bibliography). ABE students who receive reading instruction through job-related reading materials develop not only reading skills, but gain important job knowledge as well.

Counseling the ABE Student

ABE students should be made aware of the importance of reliability, cooperation, ability to follow directions, and other factors noted in Part I of this report. On the basis of the responses of supervisors surveyed in this study and previous research (Sticht, 1974), it seems that such characteristics contribute more to job success than do reading and mathematics skills. Role-play activities which involve consideration for others and following directions may be a valuable part of ABE lessons designed to prepare adults for employment.

The literacy demands of the drafting jobs and training program courses were high. It is therefore important that teachers, tutors, and counselors consider the facts presented earlier in this report, the individual students' levels of motivation, and literacy skill development before beginning to prepare the student to enter a drafting job or vocational training program. Frequency and intensity of

lessons, choice of instructional materials, and long-term duration of the instructional program are considerations depending upon the students' literacy skill level, especially in reading.

This does not mean that students with low literacy skills should always be discouraged from preparing for a drafting career. It does suggest, however, that an early and realistic estimate be made of the time and effort required to reach the goal of employment or formal training.

Summary

The mathematics and reading demands of drafting jobs and training program courses were found to be at late high school to college level. It is probable that individual experience and familiarity with specialized information reduces the perceived demands of job and training program tasks. The extent of such a reduction, however, is not known.

It was observed that the vocational training program for drafting provided students with experiences that were very similar to on-the-job tasks. Reading materials from the training program presented important basic occupational concepts through texts which were less difficult than materials found at the job sites. It was noted that research supports the practice of reducing readability levels when diffiuclt concepts are presented in written form.

Instructional recommendations emphasized the development of reading skills. Other literacy and non-literacy requirements were recognized as important, but it was clear, even in cases where high level mathematics skills were necessary, that good reading skills were essential.

The recommended approach to ABE reading instruction was a directed reading activity (DRA) because it is systematic, provides for essential skill development and practice, and permits the use of any appropriate reading material. Suggestions were presented for teaching vocabulary and on the use of important structural and organizational factors which are related to reading comprehension and memory.

Two uses of reading, reading to do and reading to learn, were discussed separately because the skills they require are distinct. Reading to do requires the ability to find information for immediate use; long-term memory is not necessary. Reading to learn requires awareness of organizational factors which aid learning and remembering.

Non-literacy factors were discussed in the section, Counseling the ABE Student, because on-the-job supervisors rated several factors such as attendance and cooperativeness to be more important to job success than reading and mathematics ability, even though the demands for literacy were high for draftsmen on the job.

Finally, it was recommended that, in using the information and recommendations presented in the report, ABE teachers should be well acquainted with the occupational interest and motivation as well as the literacy skills of their students. The literacy demands of drafting, on the job and in the training program courses, are such that some ABE students may be unable to achieve the literacy skills required within a reasonable period of time.

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APPENDIX A

TECHNICAL VOCABULARY LIST

This list is based on the total oral and written samples of the language of draftsmen both on the job and in the training program. Words included in the most frequent 1000 words of the Kucera-Francis list (based on adult language) have been deleted. The list was also edited to remove numerals; labels; names of people, places, products, and companies; contractions and possessives; and colloquialisms resulting from the oral language samples.

Some words included in the list are relatively uncommon words that occurred in the total language sample and are not necessarily technical terms. Thus, the list should be treated as a source rather than a criterion. The 74 most common words have been marked with an asterisk.

Total Sample Words = 27,874

Different Words = 3,414

ability	acquire	aircraft	angularity	arc
abrasion	acted	airspeed	annex	arched
abreast	acting	album	anniversary	arches
absence	acts	albums	annular	architect
absorption	actual	aligned	answers	architects
abutting	ad	alignment	anybody	architecture
ac*	adaptable	allocated	anymore	arise
accelerate	add	allocation	anyway	arm
acceleration	adding	allow	anywhere	arranged
accent	address	allowable	apart	arrangement
accept	addresser	allowance	apiece	arrived
acceptability	addresses	allowances	apparatus	arriving
acceptable	adds	alloy	appearance	arrow
acceptance	adequate	alright*	appendices	artistry
accepted	adequately	alteration	appendix	artwork
access	adhesive	alternative	applicable	aside
accommodate	adjacent	altitude	application	assembly
accomplish	admission	aluminum	applies	assignment
accordance	adjustment	amended	apply	assistants
accumulating	adopt	amendment	applying	assume
accuracy*	adopted	amounts	appreciate	assumed
accurate	advantage	anchor	appropriate	assuming
achieved	advantages	anchors	approved	assumption
achieving	advent	angle	approximate	assurance
acoustical	aesthetic	angled	aprons	astronaut
acquaintance	affect	angles	arbitrarily	atmospheric
acquainted	affixed	angular	arbitrary	attach

attached
attachment
attain
attempted
attics
auction
automated
automatic
automation
avoid
await
awake
aware
awful
axes
axis
baby
background
backing
backup
bacterial
balloon
bank
bar
barely
barrier
base*
baseball
baseboards
bases
basically
basketball
batch
battery
bay
beads
beam*
beams
beans
bear
bearable
beat
beats
beauty
becomes
beforehand
beg
begin
bell
bellmouth
bench
bend
bending
beneath
beneficial
besides
bet
bevel
beveled
beware
bilateral
binders
binding
bisect
bisecting
bisectors
bit
bitty
blade
blasted
block
blocking
blocks
blow
blows
boardroom
boards
boiler
boilers
bolted
bolts
bond
books
boom
bosses
bottom
boundary
bow
bowls
boxes
braced
braces
bracing
branch
branches
breadth
break
breaking
breaks
breeching
brick*
bricked
bricks
bridge
brief
briefly
broad
broke
build
builder
builders
buildings*
built
bulkheads
bundle
burn
busy
butt
button
buy
bye
cabinet
cable
cages
calculate
calculated
calculates
calculating
calculation
calculus
calling
camper
cancelled
cancels
cantilever

capable
capacities
capacity
cape
capital
carbon
career
careful
carefully
carpenters
carport
carrier
carry
carrying
cartesian
cash
casings
cast
casts
catalogued
catalogues
catch
categories
category
caught
caulking
caused
causes
causing
cavity
cedar
ceiling
ceilings
celebrating
centers
centimeter
centroid
centroids
centuries
certificate
cesspool
chair
chalk
challenge
challenging
chambers
chances
changed
channel
chap
chapter
chapters
characteristics
charts
chassis
check
checking
cheek
chimney
choose
chose
chutes
circle
circles
circuit
circuitry
circular
circumference
civil
clad
clamped
clamps
classification
classified
clay
clean
cleaned
cleaning
clearance
clearances
client
clip
closely
closest
closing
closure
cm
coal
coast
coat
coaxiality
code
codes
coffee
coincided
coke
collective
colonial
colors
columns
combination
combustible
combustion
comment
commercial
commonly
communicate
comparative
comparison
compass
compensation
competent
completed
completing
completion
complex
complicate
compliment
comply
complying
component*
components
composed
composition
compressed
compression
computation
computed
conclave
concealed
concentrate
concentric
concept
concern
concerning

concrete*	constantly	conversion	coverage	cube
concurrent	constituent	convert	covering	cubic
condensate	constructed	cool	coverings	curbs
condensation	construction	cooling	covers	currently
condition	consultation	coordinate	cracking	curtain
conductor	consults	coordination	cracklike	curve
conductors	contact	copies	cracks	curved
cone	contacted	copper	crane	custom
cones	contacts	copy	cranes	customary
confidence	contain	cord	crawl	cuts
confines	contained	cope	crazy	cutting
conflict	contains	cores	create	cycle
conform	contemporary	corners	created	cylinder
confusion	continuous	cornice	creates	cylinders
conical	contour	correct	creativity	cylindrical
conjunction	contoured	correctly	crew	damage
connect	contours	correspond	crimp	damaged
connected	contraction	corridor	criteria	dampened
connecting	contractor	corrosion	critical	dash
connection*	contrasting	corrosive	cross	date
connectors	contribute	cosign	crossing	dates
conservation	controlled	counseling	crossline	datum
considerate	controlling	counselors	crossection	daytime
consist	controls	couplings	crosswalks	dc
consistent	convenient	courses	crowbars	dealer
consists	convention	cousin	crown	dealing
constant	conversation	cover	crunch	deals

debated
debris
deceleration
decent
decimal
decimally
deck
decoration
defects
define
defined
defines
defining
definitely
definition
deflection
deform
degrees
delineated
deliver
delivery
denominator
denotes
density
depend
depending
deposit
depression
depth
derived
describe
description
descriptive
designate
designated
designation
designer
designers
designing
designs
desirable
desired
desk
destruction
detail
detailed
details
detergents
determining
develop
developing
device
devices
devoted
dew
diagonal
diagonally
diagram
diagrams
diameter*
diameters
die
differ
differs
difficulties
difficulty
dim
dimension*
dimensioned
dimensioning
dimensions*
dinner
directed
directions
director
discharge
discuss
discussed
disposal
disposed
distances
distinguish
disturbing
diver
divide
divided
dividing
divisions
document
dollars
domestic
doorknob
dot
dotted
double
doubts
downstairs
downtown
downward
draft
drafting
draftsman
drain
drainage
drains
draw*
drawing*
drawings*
drawn*
dress
drilled
drinks
drippings
driven
driver
drives
driveways
driving
drop
dropped
drops
drove
dry
duct
ducts
ductwork
dud
dug
dumbwaiter
durable
dusting
dwelling
dynamic
dynamics
easier

eating	emotional	equal*	exact	expanse
eaves	emphasis	equally	exacting	expansion
eccentric	emphasized	equals	exactly	expensive
economical	employed	equation	exactness	explain
economy	employees	equations	exam	explained
edge	emptied	equilibrium	examination	explains
editions	empty	equipped	examined	explanatory
effectively	enclose	equivalent	examples	exposed
efficiency	enclosed	erase	excavation	expressed
effluent	enclosure	erect	exceed	expressing
eight*	enclosures	erecting	exceeding	expend
eighteen	encountered	erection	exceeds	extending
eighty	ending	erosion	exception	extension
elaborate	ends	escalator	exceptions	exterior*
elbow	energy	escalators	exchange	external
elbows	engineer	essential	excluded	extinguish
electrical	engineering	establish	excuse	extra
electronic	enjoyed	establishing	exempted	extreme
elevation*	ensure	estimate	exercise	eyelets
elevations	entail	estimates	exercises	fabricated
eleven	entails	etc.	exert	fabrication
eliminate	entering	evenly	exerts	facing
eliminates	enters	event	exhaustive	factor
ellipse	enthusiasm	events	exist	factoryman
elliptical	entirely	eventually	exit	failure
elongation	entrance	everyone	exits	fairly
embedded	environment	evolved	expanded	falling

falls
false
familiar
fan
fancy
fanned
fantastic
farmer
fasten
fastened
fastening
favor
favorites
feasible
feature*
features*
February
feeder
fewer
fiber
fields
fifteen
fifteenth
fifth
fifths
fifty*
fig.*
fights
figured
figuring
file
filed
files
filled
fillet
finding
fingers
finish
finished
finishing
firebrick
fireplace
firmly
fit
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fittings
fixed
fixtures
flame
flammability
flange
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flanges
flashing
flat
flight
flooring
floors
flow
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flux
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foam
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framing
fraternal
freebody
freed
freehand
freely
frequently
friction
Friday
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fundamental
funny
fur
furnished
furniture
furred
furring
fusion
gable
gables
gaging
gallon
gallons
galvanized
games
gap
gappage
gas
gaseous
gases
gassed
gauge
gauges
gear
generated
gently
geometric
geometrical
gets
girders

giving
glass
goal
goes
gold
gorgeous
gotten
govern
governing
governs
grade
graduates
graphical
gravel
gravity
grid*
grooves
grout
guarded
guess
guide
guides
guys
gypsum
gyration
hallway
hammer
handbook
handed
handhole
handholes
handicap
handle
handrails
hang
happen
happens
happy
hardware
harness*
haul
headers
heads*
hearth
heat*
heated
heater
heaters
heating
heaviest
heel
height
helpful
herein
hereof
hereunder
hidden
highly
holdage
holders
holding
hole
holes
homes
homework
hook
hopefully
horizon
horizontal*
houses
housing
hub
hubs
hungry
hurt
hydraulic
hypotenuse
identical
identification
identified
identify
identifying
illustrate
illustration
impact
impending
implies
implying
impossible
impractical
impression
improve
inaccurate
inasmuch
inch*
inches*
inclined
included
inclusive
incomplete
inconsistent
incorrectly
increases
increasing
increment
incurred
indention
independent
indepth
indicate
indicates
indicating
indication
indicator
indirectly
inertia
inherent
initial
inner
inspection*
inspector
installation
installed
instances
institute
institution
instruction
instructor
instrument
insulating
insulation
insurance
integrally
intended
intent

intentional	isometrics	labeled	leaves	lining
interboard	items	laboratories	leaving	linings
interconnect	jambs	laborers	ledger	lip
interesting	jobs	lacking	ledges	liquid
interests	join	laid	leg	listed
interfere	joined	landed	legs	listen
interference	joining	landing	lengths	listening
interfering	joint*	lands	lesser	lists
interior	jointed	lap	lethal	littler
interiors	joints*	lapped	leveled	lives
intermediate	joist	laps	levels	load
internal	joists	largely	liability	loadbearing
interpretation	judging	lath	librarian	loaded
interpreted	jumper	laundry	libraries	loading
interpreting	jumps	layed	library	loads
interrelated	justification	layer	lieu	locate
intersect	keeping	laying	lift	located
intersected	keeps	layout*	lifting	locating
intersection*	key	layouts	lights	location*
interval	kg	lb.	liked	locations
intervals	kid	leading	limit	lock
introduced	kidding	leads	limiting	locking
introduces	kilograms	leaked	limits	locklapped
inventory	kit	leaking	linear	logical
irregular	kitchen	learn	lined	longitudinal
isolated	knocking	learning	liner	looks
isolation	knows	lease	liners	loosened

looseness
lose
losing
losses
lowest
lucky
lumber
lunch
lyrics
machine
machined
machinery
machines
magnetic
magnifies
magnitude
magnolia
mail
mainly
maintain
maintained
maintains
manhole
manhours
manpower
manufacture*
mark
marking
masonry
master
matching
materials
math
mating
matrix
maximum
meanings
measure
measured
measurement
measures
measuring
mechanical
mechanism
medium
meets
mental
mentally
mentioned
merits
mesh
message
metal*
meter
metering
meters
metric
mile
millimeter
mineral
miniaturize
minimize
minimum
minor
minus
minute
miter
miters
mm
modification
modular
module
moisture
moldings
molds
moments
Monday
monetary
moon
moreover
mornings
mortar
mortarlike
motion
motivated
mountains
mounted
mounts
movable
mph
mud
multiple
multiplied
multiply
multiplying
murder
mutual
nail
nailed
nailing
nails
naturally
nearby
nearest
neat
neatly
necessarily
necessitate
necessity
neck
necks
negative
neglecting
negligible
net
newtons
nice
nine
nineteen
ninety
nobody
noise
nominal
noncombustible
noncomplex
noncorrosive
nonmandatory
normally
notch
notched
noted
notes
noticeable
notice
nozzle

nozzles
numbered
numerators
numerical
object*
objectionable
objects
obstruction
obtain
obvious
occasion
occupancies
occupancy
occupant
occupants
occupied
occur
octagon
offering
offices
official
offset
offsets
offsetting
ogee
oil
oilfired
ok
omitted
onto
opening
openings*
opens
operable
operate
operations
operator
opposed
opposes
opposing
opposite
orange
ordered
organized
original
otherwise
ought
outer
outlet
outlets
outline
outlined
output
overall
overhang
overhangs
overhead
overlap
overlapping
overtaken
overwork
owner
pack
package
page
pages
pain
painted
panel*
paneling
panelized
panels*
papers
parachute
paragraph
paragraphs
parallel*
pardon
parent
partially
particle
parties
partition
partitions
partly
pass
passes
passing
patched
path
paths
patio
patterns
penalties
penetrant
penetration
penthouses
percent
percentage
perforated
performed
performing
perimeter
permanent
permissible
permit
permits
permitted
perpendicular
personnel
perspective
pertain
pertaining
physically
pi
pick
picked
picking
picks
pictorial
pieces
pier
piers
pigtail
pinned
pins
pipe*
pipes
piping
pit
places
placing
plain
planer
planers

planes
planned
plaster
plastic
plastics
plate*
plated
plates
platforms
played
playing
please
pleasing
pleasure
plot
plotted
plotting
plug
plugged
plumb
plumbed
plumbing
plus
plywood
printing
poke
policies
popular
porch
port
portable
portion
portions
posed
positional
positioned
positions
positive
possibility
possibly
postal
potential
pounds
poured
practical
practice
practices
precedence
precipitate
precisely
precision
predetermine
predrilled
preferably
preferred
preheating
preliminary
preparation
prepared
preparing
preplan
prescribed
presentday
presents
pressing
pressures
prevailing
prevent
prevents
previous
prices
primarily
principles
printed
printing
prints
prior
procedures
proceed
porcelain
processes
processing
produce
produced
produces
product
proficient
profile
profiles
progresses
prohibit
project
projected
projecting
projection
promised
proof
proper
properly
proportion
propose
prospective
protect
protected
protection
prove
proved
proven
provides
providing
provision
provisions
psi
ptr
pull
pulled
pulse
punched
purchase
purposes
pursued
pushed
putting
quadrant
quadrants
quantities
quantity
quarter
quarters
quick
quicker
quickly
racing
radiant
radiograph*

radius
rails
raised
ramp
ramset
random
rapid
rates
rating
raw
reactions
readily
realistic
realize
reamed
reasonable
reasons
rebound
recessed
recommended
recorded
rectangle
rectangles
rectangular
redesign
reduce
reduced
reduction
redwood
refastened
refer
reference
referenced
referred
referring
regardless
registered
registrars
regular
reinforced
reinforcement
reinforcing
relate
related
relation
relationship
relative
relatives
release
released
releases
reliable
remain
remaining
remind
reminder
remodeling
removable
remove
removed
removing
repaired
repairs
replaced
represent
represented
represents
requesting
require
requirement*
requires
requiring
requisition
resembling
reserved
reserves
reservoir
reservoirs
residence
residences
residential
resistance
resistive
resolve
respective
respects
restaurant
restricted
restrooms
rests
resulting
retaining
retardant
reveal
revealing
reverse
review
rewards
rig
ring
rings
ripped
rise
roads
rocks
rod
rolled
roof
roofs
rooms
root
rope
rough
round
rounded
rule
rules
runs
safe
safety
salvaged
salvation
sample
sang
satellite
satisfactory
satisfied
Saturday
scale
scaling
schedule
scheduled
schematics
scholarship
schooling

scissors
scratch
screen
screws
scribed
script
sea
sealed
sealer
seam
searching
seated
seating
secondary
seconds
sectional
sectionals
sections
secured
securely
securing
seep
seepage
seldom
selected
selecting
selection
self
selling
semicircle
semidiameter
semistate
send
separate
separated
separation
septic
serves
serving
setting
settling
seventy
sewage
sewer
shade
shadow
shadows
shaft
shafts
shakes
shape
shaped
shapes
sheet*
sheating
sheets
shell
shelled
shells
shield
chift
shifts
shingles
ship
shipment
shoot
shop
shorted
shortest
should
showcases
showing
shows
shrink
sides
sidewalk
sidewalks
siding
signal
signals
significant
signify
sill
sills
similarly
simplest
simplification
simultaneous
singing
singular
sir
sit
site
sitting
situations
sixteen
sixteenth
sixth
sized
sizes
sizing
sketch
sketched
sketches
sketching
skids
skilled
skip
skips
sky
skylights
slab
slabs
slanted
sledge
sleeper
sleeping
slide
sliders
slightly
slipped
slope
slopes
slots
slow
slug
smaller
smoke
smokey
smooth
smoothly
snap
snapped
socket
soil

sold
solder
solid
solution
solve
solved
solving
somebody
somehow
someone
someplace
somewhere
sooner
sorry
source
sources
spaced
spaces
spacing
span
spandrels
spec
specialize
specifically
specification*
specified*
specify
specifying
specimen
specimens
spell
spend
spherical
spiral
short
spot
spotting
spread
sprinklers
squared
squares
squaring
stability
stable
staggered
stainless
stairways
stamped
standards
standing
standpoint
starter
starters
starting
starts
stated
static
statics
stating
stationery
statistics
stays
steam
steel*
steep
stenograph
stepping
stick
sticking
stiffen
stocked
stone
stopper
stops
storage
store
stores
storm
stranded
strange
strap
straps
streets
strengths
stresses
stretch
strike
striking
strings
strip
stripped
strips
struck
structural
structure
structures
studies
stuff
style
sub
subcontract
subdivision
subgrade
subjected
subjects
subparagraph
subsection
subsequent
substances
substantial
substitute
substituting
successful
sufficient
suggest
suggestion
suitable
sum
supervisor
supper
supplement
suppliers
supply
supported
suppose
supposed
surfaces
surprised
surrounded
surrounding
surveying
suspended
swag
switch
symbol

symbols	teacher	testing	threaded	tonight
symmetrical	teaches	tests	throat	tons
symmetry	team	text	throw	tool
tables	techniques	texts	throws	tooled
tabs	tee	textural	thorough	totaled
tackwelding	tees	texture	thumbnail	touching
tadpole	telephone	textures	Thursday	touchup
tag	tellers	thank	tie	trace
tail	telling	thanks	tied	traced
takeoff	tells	theirs	ties	tracing
takes	telltale	theorem	tighten	tracks
talked	temporarily	theoretical	tightly	tract
talking	temporary	thereby	tightness	trades
tally	tenant	therein	tile	traditional
tamped	tend	thereof	till	traffic
tangent	tends	thereto	timber	trailer
tank	tensile	thick	timeconsuming	trailers
tanks	tension*	thicker	tiny	trained
tape	tentative	thickness*	tip	transfer
taped	tenth	thicknesses	tipping	transition
taper	term	thinner	tiresome	transportation
tapered	terminal	thirteen	title	transverse
tapering	terminals	thirty	toe	trapezoid
tapers	terminate	thorough	toilet	traveling
target	terminates	thoroughly	tolerance*	treated
task	termination	thousand	tolerances	treatments
tastes	terrible	thread	tomorrow	trench

trenches
trend
triangle
triangles
triangulate
trim
trimmers
truck
trucks
truss
trusses
trust
tube
tubes
tubing
tune
turns
twelve*
twenty*
twice
twisted
twisting
typical
ultrasonic
unacceptable
unacquainted
unbalanced
unbearable
uncle
uncontrolled
undercarriage
undergrown
undermining
underneath
undimensioned
unenclosed
uneven
unfired
unforseeable
unified
uniform
uniformly
unilateral
unit
units
unknown
unknowns
unless
unloading
unnecessary
unproductive
unprotected
unstayed
unsupported
unusual
unusually
unwieldy
upper
upset
upward
usable
useful
usual
UW
vacation
valley
vanish
vanishes
vanishing
vaporizer
variables
variation
variations
variety
vary
varying
vault
vaults
vector
vectors
velocity
veneer
veneers
vents
verge
verify
vertical*
vertically
vessel*
vessels*
viewed
viewing
violation
virtual
vitreous
vitrified
void
volts
volumes
wade
wagons
wainscoting
wait
wales
walk
wallboard
walls*
wants
warrant
waster
wasted
wastes
weaker
wedge
weekend
weighed
weighs
weight
weights
welcome
weld*
welded*
welder
welding
welds*
wheeler
wheeling
whereas
wherever
whoever
widely
wider
width
widths
win

wind
windlift
windows
windstorm
winter
wire*
wires*
wiring*
wishes
withstand
won
wonder
wood*
wool
worker
workers
workmanship
worksheet
worry
worse
wrap
wrapper
wrecked
wrench
yards
yell
yellow
yesterday
yourself
zero
zone

APPENDIX B

HIGHEST FREQUENCY WORD LIST

The 100 words on the following page represented 45% of all the language sampled. This list is based on the combined oral and written language samples from all occupations studied. It shows the words used most frequently by adults in the ten jobs studied and in the vocational training programs corresponding to those jobs.

Total Words	=	180,000
Total Different Words	=	9,000

the	will	your	see
of	one	was	more
to	not	get	these
and	an	has	into
a	there	must	just
is	can	any	them
in	when	he	down
it	out	got	time
for	we	know	about
that	which	then	been
you	what	don't	some
be	do	each	business
or	up	air	how
on	pressure	check	its
are	two	that's	back
I	so	but	over
this	they	system	work
with	here	through	would
as	other	valve	temperature
by	ok	going	same
if	right	well	also
have	no	use	where
all	used	than	now
at	may	it's	only
from	should	go	like

APPENDIX C

SUMMARY OF OCCUPATIONAL LITERACY REQUIREMENTS

This appendix presents a brief summary of the literacy requirements for all ten occupations studied.

SUMMARY OF OCCUPATIONAL LITERACY REQUIREMENTS

	On The Job		Training Program	
	Reading	Mathematics	Reading	Mathematics
Account Clerk	College to college graduate level	addition, subtraction, multiplication, division, decimals, fractions, business machines	11th grade to college graduate	addition, subtraction, multiplication, division, fractions, decimals. algebra
Automotive Mechanic	9th to college graduate level	basic processes, decimals, fractions, measurement	9th to college graduate level	basic processes, decimals, fractions, measurement
Draftsman	10th grade to college graduate	basic processes, through geometry, algebra, trigonometry	9th grade to college level	basic processes, through geometry, algebra, trigonometry
Electrician	college to college graduate level	basic processes, throguh geometry, algebra, trigonometry	10th grade to college graduate level	basic processes, through geometry, algebra, trigonometry
Heating and Air conditioning Mechanic	10th grade to college graduate level	basic processes, decimals, fractions, measurement, algebra	11th grade to college graduate level	basic processes, fractions, decimals, measurement
Industrial Maintenance Mechanic	10th grade to college graduate level	basic processes through trigonometry	10th grade to college graduate level	basic processes, decimals, fractions, measurement
Licensed Practical Nurse	10th grade to college level	addition, and subtraction--more necessary to dispense medication	12th grade to college graduate level	addition and subtraction
Machine Tool Operator	9th to college graduate	basic processes, decimals, measurement	9th grade to college level	basic processes, decimals, measurement
Secretary	College to college graduate level	basic processes, decimals, fractions, business machines	10th grade to college level	basic processes, decimals, business machines
Welder	few materials--reading of single word information required	basic processes, fractions, decimals, measurement	8th grade to college graduate level	basic processes, fractions, decimals, measurement, algebra